

01/20/99

NEW UTILITY PATENT APPLICATION
TRANSMITTALJc135 U.S. PTO
09/23/97

01/20/99

☐ DUPLICATE

Address to:

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, DC 20231

Attorney Docket No.

EM/CHING/4315

First Named Inventor
(or identifier)

CHING et al.

Total Pages

20


This submits a new application under 37 CFR 1.53(b).

Entitled:

A BACKLIGHT SOURCE DEVICE WITH CIRCULAR ARC DIFFUSION
UNITS

- ☒ 1. Submitted herewith are the following:
- 7 pages of specification, including an Abstract,
 4 sheet(s) of drawings, and
 13 claim(s).
- ☒ 2. Submitted herewith is an Oath/Declaration signed by each inventor.
- ☐ 3. Submitted herewith are the following:
- ☐ signed Independent Inventor Small Entity Statement(s),
 ☐ signed Small Business Small Entity Statement(s),
 ☐ signed Non-Profit Small Entity Statement(s),
 ☐ signed Non-Inventor Small Entity Statement(s),
- ☐ 4. A preliminary amendment is enclosed.
- ☐ 5. Submitted herewith is an Information Disclosure Statement, pages of Form PTO-1449, and one copy of each document listed thereon.
- ☒ 6. An assignment of the invention to INDUSTRIAL TECHNOLOGY RESEARCH INSTITUTE.
- ☐ 7. A certified copy of application no. in .
- ☒ 8. The Commissioner is authorized to credit any over payment and charge any deficiency in any fees required under 37 CFR 1.16, 1.17 and/or 1.18, to Deposit Account No. 02-0200.
- ☒ 9. A check in the amount of \$ 800.00 is submitted herewith.
- ☐ 10. Other:

THE FILING FEE IS CALCULATED AS FOLLOWS:

Basic Fee:				\$760.00	
Total Claims:	13	- 20 =	0	X \$18 =	\$0.00
Independent Claims:	1	- 3 =	0	X \$78 =	\$0.00
Correspondence Address: BACON & THOMAS 625 Slaters Lane, 4 th Floor Alexandria, VA 22314-1176				Multiple Dependent Claim (add \$260.00):	
				Subtotal:	\$760.00
				50% Reduction if Small Entity Status:	
Phone: 703-683-0500 Fax: 703-683-1080				Total:	\$800.00
Date:	Name:			Signature:	Reg. No.
January 20, 1999	Eugene Mar				25,893

A BACKLIGHT SOURCE DEVICE WITH CIRCULAR ARC
DIFFUSION UNITS

FIELD OF THE INVENTION

5 The present invention relates to a backlight source device, and especially to a backlight source device with circular arc diffusion units.

BACKGROUND OF THE INVENTION

10 The present invention is suitable in fabrication of LCDs, backlight displays, backlight plate of slices, advertisement billboard and the other devices with backlight source device.

With the improvement of technology, LCDs, backlight displays, backlight plate of slices, advertisement billboard and the other
15 devices using backlight source device must be used widely, thus a backlight source device with improving uniform illumination is eagerly demanded.

A light guide plate 1 in the prior art is shown in Fig.1, which cause a printing pattern of light guiding plate 1 of a lateral light source 11.
20 The pattern is formed by a plurality of trenches or convex strips, or matrix points, and other diffusion unit, or a plurality of parallel trenches with equal spaces and depths for diffusing and reflecting light of lateral light source.

The defects of the prior art backlight source device is that in
25 printing, the usability of the light of the front face is relative low.

Since the angles of all the diffusion units can not be changed. Thus the output direction of the diffusing light can not be controlled.

For example, for straight parallel trenches on the light guide plate of a backlight source device, non-uniform light strip will be formed.

5 The light reflected from the area near the middle of the radiating area of the lateral light source 11 is stronger than that farther from the middle, and trenches with equal space and depth can cause that the emitted light are distributed non-uniformly.

10 It is difficult to control the output angle of the output light from the light guide plate of a backlight source device, especially in the two sides of the diffusion unit 12. In the place near the two sides of the diffusion units, the angle formed by the line between the lateral light source and the diffusion unit and the parallel lines of the diffusion units cause that a vertical projection can not be formed so that the
15 angle of light output can not be well controlled.

SUMMARY OF THE INVENTION

Accordingly, the object of the present invention is to provide a backlight source device having circular arc diffusion units so that the
20 light reflected from lateral light source becomes more uniform.

Another object of the present invention is to provide a backlight source device with circular arc diffusion units for preventing the dark and light regions are formed by the backlight source.

A further object of the present invention is to provide a backlight
25 source device with circular arc diffusion units, in which a simplest

design is used to control the light output angle of the backlight source device and the illumination thereof is improved greatly.

In order to attain the aforementioned objects, the backlight source device with circular arc diffusion units in the present invention includes a transparent guide plate with circular arc diffusion units on the front or rear surface thereof, each circular arc diffusion unit having a reflecting surface; a diffusion piece above the guide plate; a reflecting piece below the guide plate; and a lateral light source.

The circular arc diffusion units of the transparent guide plate are convex or concave diffusion units, and the thickness of the guide plate is decreased with the distance to the lateral light source for reducing the loss of light energy.

The circular arc diffusion units are distributed with unequal distances. The reflecting surfaces of the circular arc diffusion units have different heights which are increased with the distances to the lateral light source. The cross section of the circular arc diffusion units has a V or circular arc shape.

The projection area of the diffusion units on the guide plate may be increased with the distance to the lateral light source. The projection area of the diffusion units on the guide plate may be increased with the distance to the light lateral source, the width of the projection area is between 0.05mm ~ 1mm.

The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an elevation view of a prior art backlight source device.

Figs. 2 ~ 6 are the elevation view for different embodiments of the backlight source device of circular arc diffusion units in the present invention.

Figs. 7 ~ 9 are the lateral cross sectional and schematic view for different embodiments of the backlight source device of circular arc diffusion units in the present invention.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference now to Figs. 2 ~ 9, the backlight source device of the present invention mainly comprises a transparent light guide plate 2 made by plastic (Acryl, polycarbonate) or glass or other transparent materials; a diffusion piece 3 above the light guide plate 2, wherein a prism can be added above the light guide plate or the diffusion piece; 15 a reflecting piece 4 below the light guide plate 2; and a lateral light source 5 which is preferred a linear light source.

In the present invention, at the front or rear surface of the transparent light guide plate 2, at least one surface has circular arc 20 convex diffusion units 21 (referring to Fig. 7 or 8) or concave diffusion units (referring to Fig. 9). The cross section of the diffusion unit 21 may have a V shape (as shown in Fig. 7 or 8) or circular arc (as shown in Fig. 9) or other proper shape, such as hyperbolic or elliptic shapes. The surfaces of the circular arc diffusion units may be smooth 25 or coarse. If the surface is a mirror surface, then the diffusion effect

will reduce.

Further, in the present invention, the aforementioned plurality of diffusion units are distributed with unequal distances (referring to Fig. 8, where $D1 > D2 > D3$). Preferably, in the present invention, the heights of the diffusion units 21 are increased to the distance with the lateral light source (as shown in Figs. 7-9).

The circular arc shape of the diffusion units 21 may distributed with an inverse direction (as shown in Fig.3, Comparative to Fig. 2) or distributed along a diagonal line (as shown in Fig. 4), and may be interlaced by two alternatively diffusion units (as shown in Figs. 5 and 6). Other distribution for arranging the circular arc diffusion units 21 is also included within the spirit of the present invention.

The diffusion unit 21 of the transparent guide plate 2 of the present invention can be formed by cutting, discharging, etching, laser and other methods. The guide plate 2 can be made by injection, thermal pressing, extrusion molding, or other method.

The projection area of the diffusion units 21 on the guide plate 2 may be increased with the distance to the lateral light source, a preferred width W is $0.05\text{mm} \sim 1\text{mm}$. The thickness of the guide plate 2 can be decreased with the distance to the light source for reducing the loss of light energy.

The effect of the present invention

1. By the present invention, the reflecting light strength of the reflecting surface can be increased and the power loss is reduced,

thus the average illumination of the backlight source device is increased.

2. In the present invention, the central line of the diffusion units are as close to the light source so to conveniently control the light output angle and thus to increase the illumination.
3. The dark and light regions in the backlight source device can be removed by the present invention so that the illumination of the backlight becomes more uniform.
4. The present invention is fabricated easily and many ways may be used for producing the present invention.

In summary, in the present invention, circular arc diffusion units are distributed on the guide plate 2 for deleting the dark and light regions of the backlight source device so that the illumination of the backlight area becomes more uniform and the illumination also increases.

Although the present invention has been described with reference to the preferred embodiments, it will be understood that the invention is not limited to the details described thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

What is claimed is:

1. A backlight source device with circular arc diffusion units comprising:
a transparent guide plate with circular arc diffusion units on the front or
rear surface thereof, each circular arc diffusion unit having a reflecting
5 surface;
a diffusion piece above said guide plate;
a reflecting piece below said guide plate; and
a lateral light source.
- 10 2. The backlight source device with circular arc diffusion units as claimed in
claim 1, wherein the circular arc diffusion units of the transparent guide
plate are convex diffusion units.
3. The backlight source device with circular arc diffusion units as claimed in
claim 1, wherein said circular arc diffusion units of the transparent guide
plate are concave diffusion units.
- 15 4. The backlight source device with circular arc diffusion units as claimed in
claim 1, wherein said circular arc diffusion units are distributed with
unequal spaces.
5. The backlight source device with circular arc diffusion units as claimed in
claim 1, wherein said reflecting surfaces of said circular arc diffusion
20 units have different heights which is increased with the distances to said
lateral light source.
6. The backlight source device with circular arc diffusion units as claimed in
claim 1, wherein at least two sets of said circular arc diffusion units are
alternatively interlaced on said light guide plate.
- 25 7. The backlight source device with circular arc diffusion units as claimed in

claim 1, wherein the cross section of said circular arc diffusion units has a V shape.

8. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein the cross section of said circular arc diffusion units has a circular arc shape.

9. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein the projection area of said diffusion units on said guide plate is increased with the distance to said lateral light source.

10. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein the projection area of said diffusion units on said guide plate is increased with the distance to said lateral light source, the width of the projection area is between 0.05mm ~ 1mm.

11. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein the thickness of the guide plate is decreased with the distance to said lateral light source for reducing the loss of photo energy.

12. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein said circular arcs of said diffusion units are distributed in a inverse direction around the same center.

13. The backlight source device with circular arc diffusion units as claimed in claim 1, wherein said circular arcs of said diffusion units are distributed along a diagonal line.

ABSTRACT

A backlight source device with circular arc diffusion units in the present invention includes a transparent guide plate with circular arc diffusion units
5 on the front or rear surface thereof; a diffusion piece above the guide plate; a reflecting piece below the guide plate; and a lateral light source. Therefore, the dark and light regions in the backlight source device can be removed by the present invention so that the illumination of the backlight becomes more
10 illuminant and more uniform.

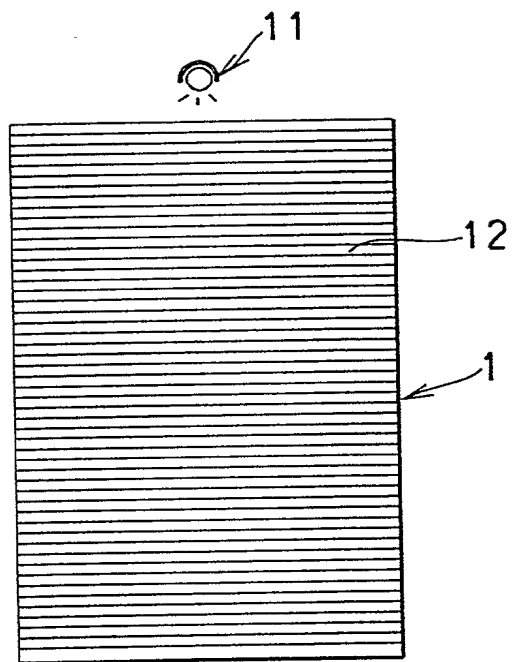


FIG. 1

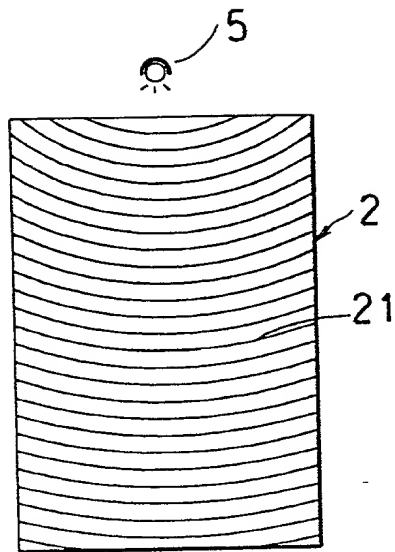


FIG. 2

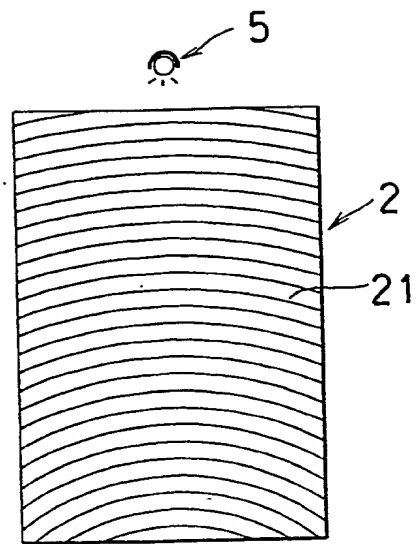


FIG. 3

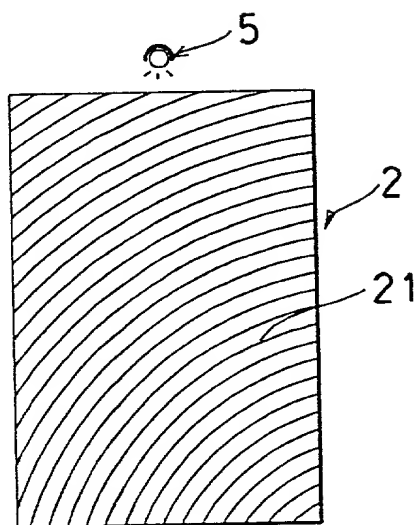


FIG. 4

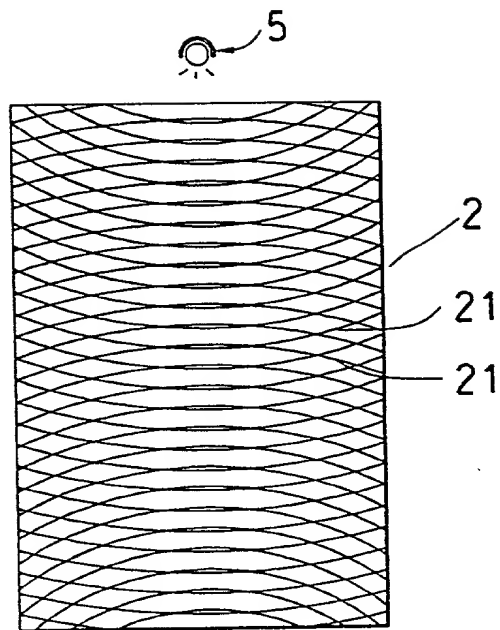


FIG. 5

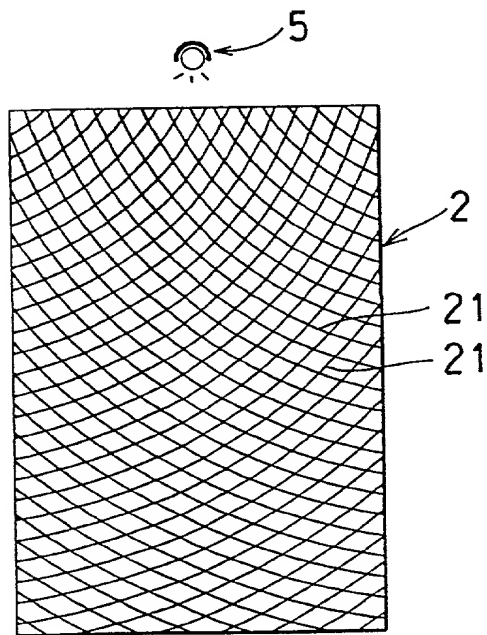


FIG. 6

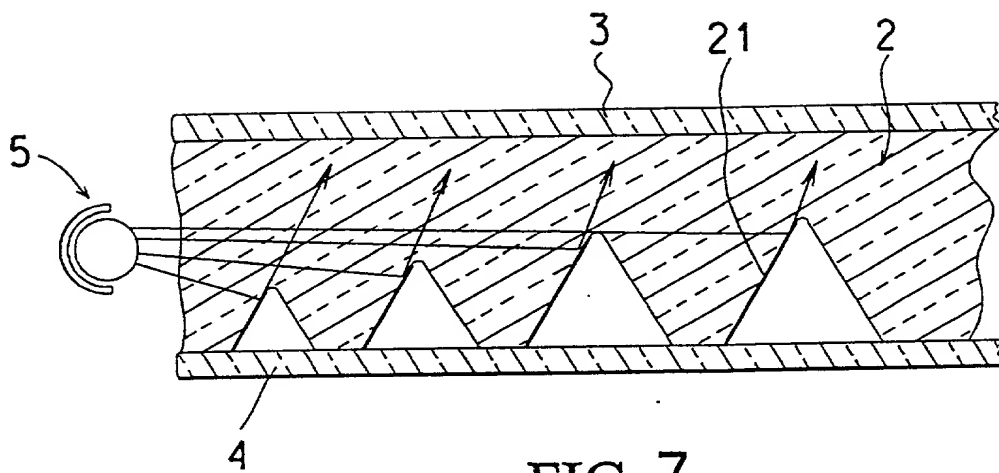


FIG. 7

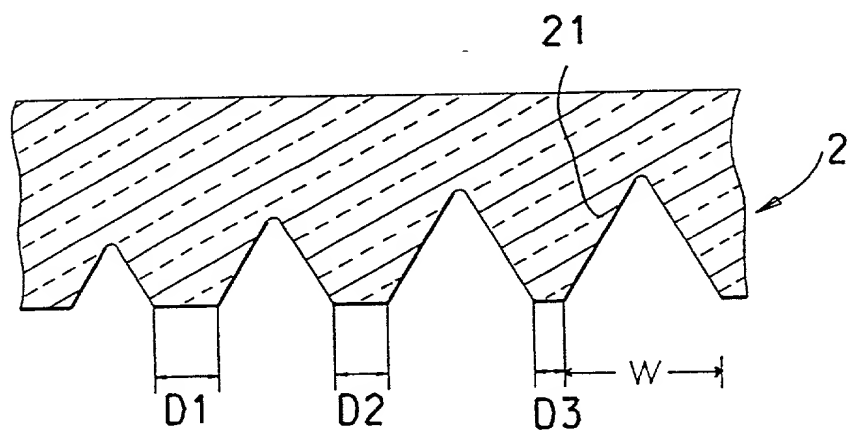


FIG. 8

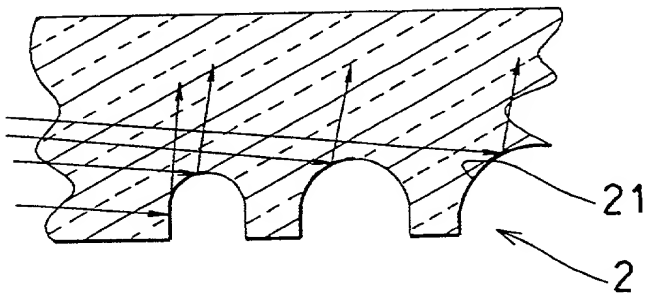


FIG. 9

DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled:

A BACKLIGHT SOURCE DEVICE WITH CIRCULAR ARC DIFFUSION UNITS

the specification of which (check one):

☒ is attached hereto.

☐ was filed on:

and (if applicable) was amended on:

☐ was filed on:

and (if applicable) was amended on:

as Application Serial No.:

as International Application (PCT) No.:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56*. I hereby claim foreign priority benefits under *Title 35, United States Code §119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No
87218955	Taiwan(R.O.C.)	17/11/1998	✓	

I hereby claim the benefit under *Title 35, United States Code, §120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, §112*, I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application Number	Filing Date	Status - Patented, Pending or Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001 of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No. 26,382; Charles R. Wolfe, Jr., Reg. No. 28,680; Thomas J. Moore, Reg. No. 28,974; David E. Dougherty, Reg. No. 19,576; Bruce H. Troxell, Reg. No. 26,592, and Wood & Wu

I (we) authorize my(our) attorneys to accept and follow instructions from _____ regarding any matter related to the preparation, examination, grant and maintenance of this application, any continuation, continuation-in-part or divisional based thereon, and any patent resulting therefrom, until I(we) or my(our) assigns withdraw this authorization in writing.

Send correspondence to: BACON & THOMAS
625 Slaters Lane - 4th Floor
Alexandria, VA 22314

Telephone Calls to:
(703) 683-0500

Full Name of First or Sole Inventor Hsu Chao-Ching	Citizenship Taiwan(R.O.C.)
Residence Address No.52, Lane 143, Sec. 2, Da Cheng Road, Tianan City, Taiwan,R.O.C.	Post Office Address <input checked="" type="checkbox"/> Same as Residence
DATE Dec. 24 1998	SIGNATURE Hsu chao-ching

DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

Page 2/2

Full Name of Joint Inventor Tzeng GWO-Juh	Citizenship Taiwan(R.O.C.)
Residence Address No.36, Lane 489, Tu Cheng Road, Da Li City, Taichung, Taiwan,R.O.C.	Post Office Address <input checked="" type="checkbox"/> Same as Residence
DATE Dec. 24, 1998	SIGNATURE Tzeng Gwo-Juh

Full Name of Joint Inventor	Citizenship
Residence Address	Post Office Address <input type="checkbox"/> Same as Residence
DATE	SIGNATURE

Full Name of Joint Inventor	Citizenship
Residence Address	Post Office Address <input type="checkbox"/> Same as Residence
DATE	SIGNATURE

Full Name of Joint Inventor	Citizenship
Residence Address	Post Office Address <input type="checkbox"/> Same as Residence
DATE	SIGNATURE

Full Name of Joint Inventor	Citizenship
Residence Address	Post Office Address <input type="checkbox"/> Same as Residence
DATE	SIGNATURE

Full Name of Joint Inventor	Citizenship
Residence Address	Post Office Address <input type="checkbox"/> Same as Residence
DATE	SIGNATURE